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ASSIGNEE-INFORMATION:

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ABSTRACT:

CHG DATE=19990617 STATUS=O> In a gear pump, or motor, of the externally-meshing type the idler gear 30 is mounted on a shaft 33 and wear-resistant plates 23, 25 are lodged in bores 15, 17 for the shaft bearings 19, 20 to obviate abrasion of housing end-members 12, 13 by the shaft end-surfaces. The members 12, 13 may be made of die-cast aluminium. A wear-resistant plate 24 may be provided in a bore 16 for the inner bearing 20 associated with the driving gear 29. <IMAGE>

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(54) Rotary positive-displacement fluid-machines

(57) In a gear pump, or motor, of the externally-meshing type the idler gear 30 is mounted on a shaft 33 and wear-resistant plates 23, 25 are lodged in bores 15, 17 for the shaft bearings 19, 20 to obviate abrasion of housing end-members 12, 13 by the shaft end-surfaces. The members 12, 13 may be made of die-cast aluminium. A wear-resistant plate 24 may be provided in a bore 16 for the inner bearing 20 associated with the driving gear 29.

FIG.1

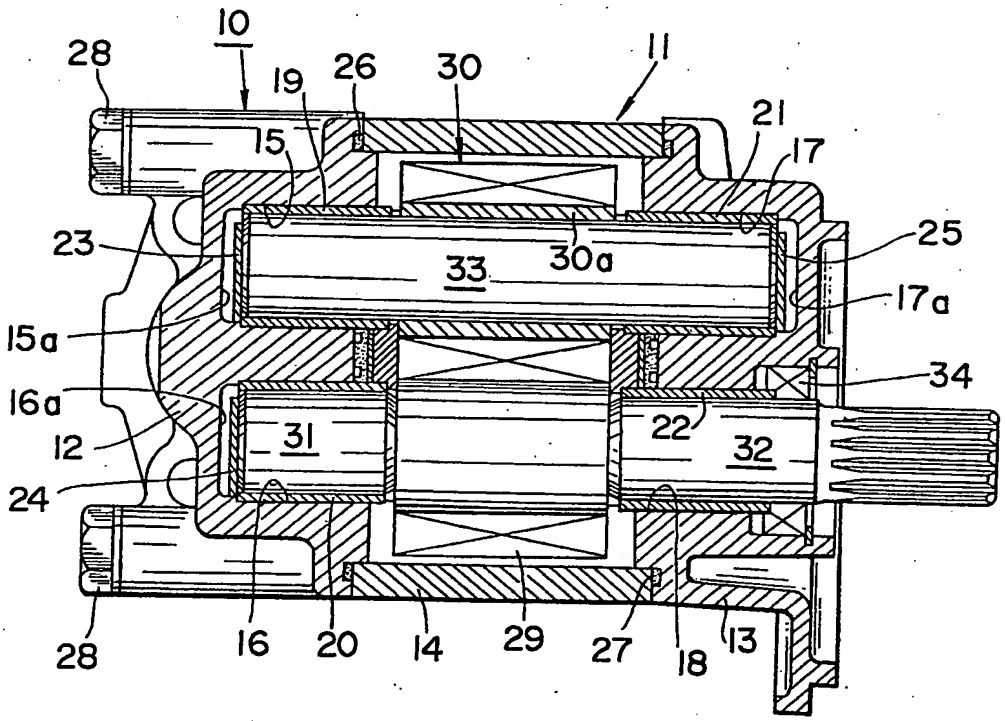

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FIG.1

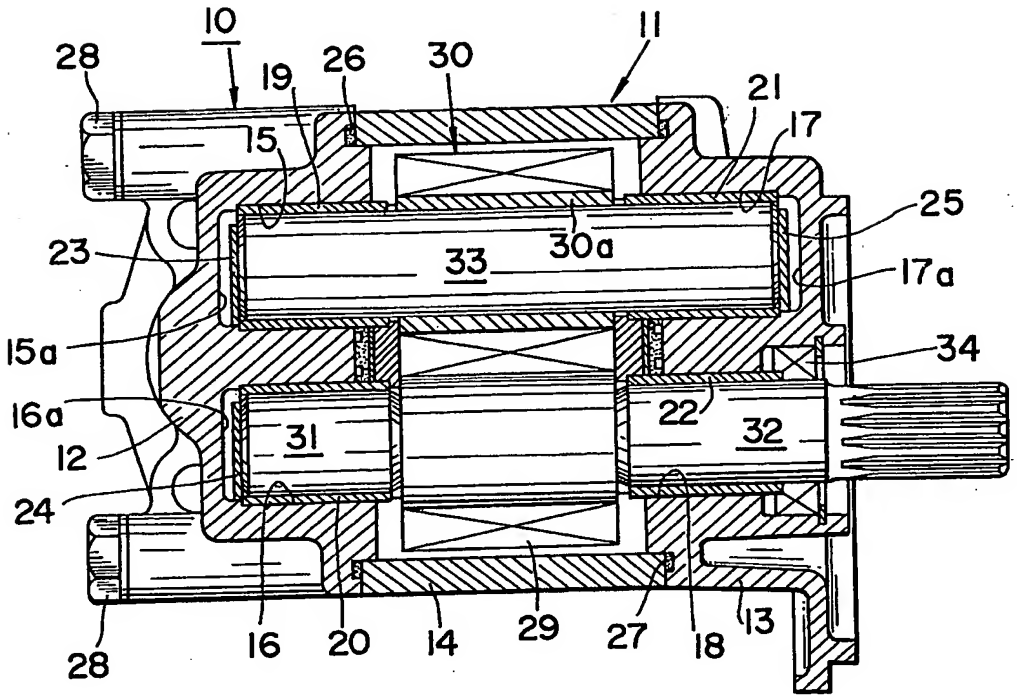


FIG.2

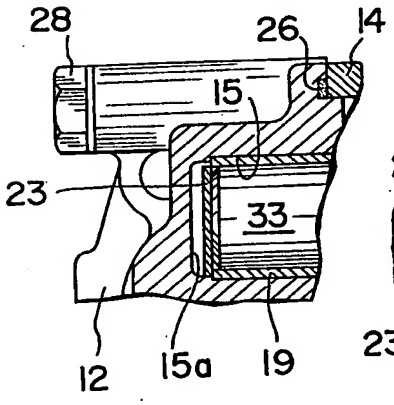


FIG.3

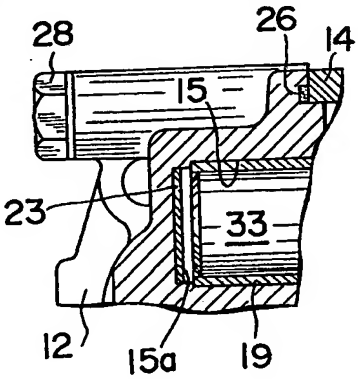


FIG.4

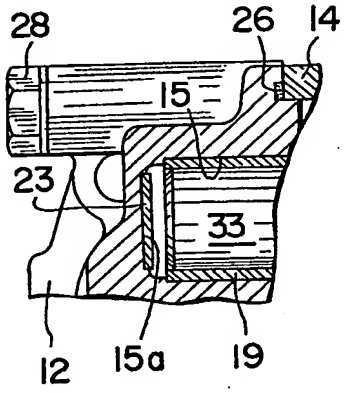


FIG.5A

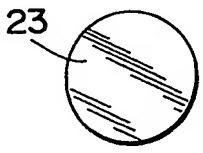
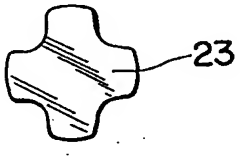


FIG.5B



SPECIFICATION

Improvement of gear pumps or motors

The present invention relates to gear pumps or motors of such a type wherein a pair of driving and driven gears meshing each other with the outer teeth are incorporated; the driven gear at least among the said driving and driven gears is formed by passing its separate shaft through the gear body; shafts of both the gears are supported to at the both sides rotating freely in the bearing holes of the housing.

Since the driven gear is fabricated by passing its separate shaft piece through the gear body, gear pumps or motors of such a type are inexpensive to manufacture and much improved with respect to shaft strength as compared with those using a driven gear formed in one piece, the gear body and shaft inclusive. As a result, driven gears of the said type are often used in low-cost gear pumps or motors using housings of die-cast aluminum.

However, in a gear pump or motor of this type, there occurs during the operation a phenomenon that the shaft of the driven gear shifts in the axial direction, leaving the gear body behind, and strikes at the end surfaces against the bottom parts of the bearing holes in the housing of aluminum die casting. Then, since the said shaft is usually made of much harder material than the housing material, the housing is worn rapidly at the bottom parts of the bearing holes, resulting in a significant degradation of the durability as a gear pump or motor.

In order to eliminate such problems, therefore, a measure has been taken in the past that two annular grooves are formed around the shaft of the driven gear and fitted with a C-shaped pins, to hold the gear body between these pins and thus prevent the shaft from travelling in the axial direction of the gear. However, such a measure results not only in an increase in manufacturing cost for the driven gear but also in a degradation of the shaft strength as the annular grooves for fitting C-pins are cut around the shaft.

The purpose of the present invention is, therefore, to offer gear pumps or motors of such a type as the aforementioned in which the end surfaces of the shaft of the driven gear may be prevented as possible in operation from striking the housing at the bottom parts of the bearing holes and causing rapid wear by means of an extremely simple mechanism without using any special processing to the said shaft.

To this end, in the present invention, plates made of a harder material than the housing material are disposed so as to face the shaft end surfaces of the driven gear in the bearing holes of the housing; thus the shaft end surfaces of the driven gear are prevented by these plates from striking directly the housing at the bottom parts of the bearing holes and causing rapid wear of the said parts during operation of the gear pump or motor.

Referring to the drawings attached, application examples will be detailed further in the following. Although the present invention is described refers to gear pumps in the following, those principles involved are applicable, as they are, to gear motors as well.

Fig. 1 represents a longitudinal section showing an application example of gear pumps using the present invention.

Fig. 2 represents a longitudinal section showing the essential parts of another application example.

Figs. 3 and 4 represent longitudinal sections showing the essential parts of other application examples.

Figs. 5A and B represent application examples showing the plates of different shapes.

In Fig. 1, the gear pump 10 according to the present invention has a housing 11 consisting of an end cover 12, mounting flange 13 and casing 14, among which at least the end cover 12 and the mounting flange 13 are made of an aluminum die casting so as to minimize manufacturing costs.

The end cover 12 and mounting flange 13 are provided with bearing holes 15, 16, 17, 18, in which 15—18 bushings 19, 20, 21, 22 are fitted, respectively. Among the said bearing holes 15—18, those 15—17 having the bottom part 15a, 16a, 17a imbedded plates 23, 24, 25, which are made by punching a mild steel plate and located loosely at the respective bottom parts 15a—17a.

In the gear pump 10 of this application example, the casing 14 is of cylindrical type being made of thick walled steel tubing; both open ends of this casing 14 are closed firm and liquid-tight with the end cover 12 and the mounting flange 13, respectively, by using seal members 26, 27 and through bolts 28.

In the said casing 14, a pair of driving gear 29 and driven gear 30 are housed meshing each other as the pumping element. In this application example, the said driving gear 29 is formed in a piece, its shafts 31, 32 provided at the both sides inclusive, while the driven gear 30 is formed by manufacturing its gear body 30a and shaft 33 separately and by passing the latter 33 through the former 30a. Normally, these shafts 31—33 as well as the gears 29, 30, 30a are made of case hardened steel.

The said driving gear 29 and driven gear 30 are housed in the casing 14 before the end cover 12 and the mounting flange 13 are fitted to the said casing 14. Therefore, when the end cover 12 and the mounting flange 13 are fitted afterwards, shafts 31—33 of the said driving gear 29 and driven gear 30 are inserted into bearing holes 15—18 of the said end cover 12 and mounting flange 13, being supported thus to rotate freely in the housing 11 by means of bushings 19—22 fitted in the said bearings holes 15—18.

At the same time, the shaft 32 of the driving gear 29 protrudes outward passing through the mounting flange 13 and may be connected to a power source at the outside of the gear pump 10. That part of the mounting flange 13 through which the said shaft 32 extends is fitted with an

oil seal 34 to seal tightly the clearance between the shaft 32 and the mounting flange 13.

Principles of gear pump 10 of the type shown in Fig. 1 are well known, for instance, as seen in the specification of US Patent No. 3,986,800 with the exception of the fact that plates 23—25 are imbedded in the bearing holes 15—17 of the end cover 12 and mounting flange 13. It is also obvious that the present invention is applicable not only to gear pumps of such a type but also to those of other types as seen, for instance, in the specification of US Patent No. 3,748,063 or of US Patent No. 3,876,347. Since the type of gear pumps by itself has no direct relation to the present invention in particular, any further description is omitted here for simplicity.

Thus, in the operation of the said gear pump 10, even if the shaft 33 of the driven gear 30 shifts to the right or left leaving the gear body 30a behind, the end surface of the said shaft 33 does not strike the bottom part 15a of the bearing hole 15 in the end cover 12 or the bottom parts 17a of the bearing hole 17 in the mounting flange 13 directly but through the medium of the plate 23 or 25.

In this case, the shaft 33 made of case hardened steel has normally a Rockwell hardness as high as 60 as measured with a C-scale, while the end cover 12 and mounting flange 13, both of which are made of die-cast aluminum, have a low Brinell hardness ranging from 80 to 90. Therefore, if the end surface of the shaft 33 were to strike the bottom part 15a or 17a of the bearing hole 15 or 17 directly, the bottom part 15a or 17a would rapidly wear. In the present invention, however, since the end surface of the shaft 33 strikes the bottom part 15a or 17a of the bearing hole 15 or 17 through the medium of the plate 23 or 25 made of mild steel having a Brinell hardness in the order of 110—120 as aforementioned, the end surface of the shaft 33 is abraded by the surface of this plate 23 or 25 and the wear of the bottom part 15a, 17a of the bearing hole 15, 17 is lessened considerably. This significant effect has been confirmed also by the results of an endurance test performed by us.

In the abovementioned application example of Fig. 1, plates 23, 24 are imbedded in both of the bearing holes 15, 16 of the end cover 12. The reason is that either the plate 23 or 24 will always be located at the end surface of the shaft 33 of the driven gear 30 even if the end cover 12 is fitted without regard to which side comes up or down and this enables labor-savings in the fitting work of the end cover 12. Although the end cover 12 and the mounting flange 13 are formed in separated pieces from the casing 14, the end cover 12 and casing 14 or the mounting flange 13 and casing 14 may be formed as a single piece.

Furthermore, as seen in the application example of Fig. 2, where plates 23—25 having a larger outer diameter than the inner diameter of bushings 19—21 are incorporated before the said bushings 19—21 are fitted in the bearing holes 15—17, the respective bushings 19—21 may prevent the plates 23—25 from dropping out of the bearing holes 15—17 during assembly of the gear pump 10, thus facilitating the assembly. This is also the same in the case where the plates 23—25 are force fit into the bearing holes 15—17 as seen in the application example of Fig. 3 or where they are cast into the bottom parts 15a—17a of the bearing holes 15—17 beforehand as seen in the application example of Fig. 4.

The plates 23—25 may be formed either in a disc shape as shown in Fig. 5A or in a cross shape as shown in Fig. 5B. Where they are formed in a cross shape in particular, the contact surfaces between the ends of the shaft 33 and the plates 23—25 may be oiled easily, and thus the abovementioned wear resisting effect on the bottom parts 15a—17a of the bearing holes 15—17 becomes further improved.

CLAIMS

1. A gear pump or motor comprising a driving gear which has a shaft at each of its sides, a driven gear which is formed by passing a shaft through the gear body so as to mesh with the said driving gear, bearing holes which are formed in the housing so as to support the respective shafts of the said driving and driving and driven gears to rotate freely and wear resisting plates which are incorporated in the bottom parts of the bearing holes of the housing so as to face the end surfaces of the shaft, at least, of the said driven gear.

2. A gear pump or motor as claimed in claim 1 wherein the said bearing holes of the housing are provided with bushings, and plates having a larger outer diameter than the inner diameter of the respective bushings concerned are used before these bushings are fitted in the bearing holes.

3. A gear pump or motor as claimed in claim 1 wherein the said plates are force bit into the bearing holes in the housing.

4. A gear pump or motor as claimed in claim 1 wherein the said plates are cast into the bottom parts of the bearing holes in the housing.

5. A gear pump or motor as claimed in claim 1 wherein the wear resisting plate is incorporated also into the bearing hole supporting one of the shafts of the driving gear.

6. A gear pump or motor substantially as hereinbefore described with reference to and as shown in the drawing.

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